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Materiel Test Procedure 6-2-220
Electronic Proving Ground

U. S. ARMY TEST AND EVALUATION COMMAND
COMMODITY ENGINEERING TEST PROCEDURE

3809

RADAR, FIELD ARTILLERY

1. OBJECTIVE

The objective of the procedures outlined in this MTP is to provide a means of evaluating the technical performance, engineering adequacy, and characteristics of field artillery radar systems relative to criteria contained in Qualitative Materiel Requirements (QMR), Small Development Requirements (SDR), Technical Characteristics (TC) or other applicable criteria, and determining their suitability for an intended use.

2. BACKGROUND

The flexibility, mobility and effectiveness of mortar fire in combat necessitated the development of methods and equipment to give first round acquisition of enemy mortar rounds and convert the information obtained into weapon location coordinates. Pioneering efforts in the field of artillery radar development included the modification of Surveillance Radar AN/TPS-3, into Countermortar Radar AN/TPQ-3 and concurrent modification of Radar Set SCR 784 into Counterbattery Radar AN/MPQ-9.

Existing capabilities of the current standard countermortar/counterbattery systems (the AN/MPQ-4A and AN/MPQ-10, respectively) are subject to interim refinement pending development of an improved radar with combat effectiveness significantly increased over that of the presently available equipments. Engineering tests of new or improved field radar systems are required to ensure adherence to design requirements.

3. REQUIRED EQUIPMENT

a. Open field test area
b. Radar resolution facility
c. Electronic laboratory with screen room facilities
d. Tactical vehicles or simulated targets as required
e. Noise figure meter
f. Test antennas
g. Signal sampling networks
h. Variable and fixed attenuators
i. Signal generators
j. Frequency meters
k. Field intensity meters
l. Oscilloscope
m. Spectrum Analyzer
n. Appropriate mortars or howitzers with crews

4. REFERENCES

20040112225

A. Report of Countermortar Tests, The Artillery and Guided Missile School, August 1956.
B. Test of Mortar Locator Radar Set AN/KPQ-1, Marine Corps Equipment Board, June 1958.
C. Radiation Laboratory Series, Vols. 1-28, Massachusetts Institute of Technology, 1948.
D. Radar System Measurements, Philco Corp., 1959.
E. Skolnik, M. I., Introduction to Radar Systems, McGraw-Hill, 1962.
F. QMR for Radar, Mobile, Hostile Artillery and Mortar Location, CDOG subparagraphs 439c (1) and (4), (U).
G. Plan of Test, Engineering and Operational Evaluation Tests of Ground-to-Ground Surveillance Radars, RCA Service Co., 1962.
H. Noise Figure Primer, Hewlett Packard Application Note 57.
I. FM 6-160, Radar Set AN/MPQ-10.
J. FM 6-161, Radar Set AN/MPQ-4A.
K. MIL-STD-449(-), Radio Frequency Spectrum Characteristics, Measurement of.
L. MIL-STD-461(-), Electromagnetic Interference Characteristics, Requirements for Equipment.
M. MIL-STD-462(-), Electromagnetic Interference Characteristics Measurement of.
N. MTP 5-2-519, Moving Target Indicators.
O. MTP 5-2-528, Ground Guidance System Tests.
P. MTP 5-2-529, Radar Receivers.
Q. MTP 6-2-020, Radar Antenna Subsystem Tests.
R. MTP 6-2-036, Combat Surveillance, Ground.
S. MTP 6-2-063, Computer, Digital, Field Artillery.
T. MTP 6-2-222, Radar, Target and Ranging.
U. MTP 3-1-002, Confidence Intervals and Sample Size.
V. MTP 5-2-510, Electronic Noise Tests of Missile Systems.

5. SCOPE

5.1 SUMMARY

5.1.1 Technical Characteristics

The procedures outlined in this MTP provide general guidance for evaluating the technical performance and characteristics of field artillery radar. The cumulative test results together with the results of the appropriate common engineering tests will allow an estimate of the test item's capabilities as a countermortar/counterbattery and battlefield surveillance radar device and the suitability of the equipment to meet the required military needs.

The specific tests to be performed along with their intended objectives, are listed below:

a. Transmitter Tests - The objective of this subtest is to determine the adherence to design specifications of the radar transmitter as a major component of the test item.

b. Receiver Tests - The objective of this subtest is to determine the degree of compliance with design specifications of the radar receiver as a major component of the test item.

c. Antenna Tests - The objective of this subtest is to determine the degree of compliance with design specifications of the radar antenna as a major component of the test item.

d. Moving Target Indicator Tests - The objective of this subtest is to evaluate the capability of the test item to discern or discriminate moving targets.

e. System Tests - The objective of this subtest is to determine the degree of compliance of the monostatic radar system to the overall system design requirements.

5.1.2 Common Engineering Tests

Not included in this MTP are the following Common Engineering Tests which apply to these commodities:

a. 6-2-500, Physical Characteristics
b. 6-2-502, Human Factors Engineering
c. 6-2-503, Reliability
d. 6-2-504, Design for Maintainability
e. 6-2-507, Safety

5.2 LIMITATIONS

This document excludes testing of the test item's capabilities as a fire direction - counterfire adjustment facility.

6. PROCEDURES

6.1 PREPARATION FOR TEST

a. Select test equipment having an accuracy of at least ten times greater than that of the function to be measured, that is in keeping with the state of the art, and with calibrations traceable to the National Bureau of Standards.

b. Record the following information:

1) Nomenclature, serial number(s), manufacturer's name and function of the item(s) under test.
2) Nomenclature, serial number, accuracy tolerances, calibration requirements, and last date calibrated of the test equipment selected for the tests.

c. Ensure that all test personnel are familiar with the required technical and operational characteristics of the item under test, such as stipulated in Qualitative Materiel Requirements (QMR), Small Development Requirements (SDR), and Technical Characteristics (TC).

d. Review all instructional material issued with the test item by the manufacturer, contractor, or government, as well as reports of previous tests conducted on the same types of equipment, and familiarize all test personnel with the contents of such documents. These documents shall be kept readily available for reference.

e. Prepare record forms for systematic entry of data, chronology of test, and analysis in final evaluation of the test item.

f. Prepare adequate safety precautions to provide safety for personnel and equipment, and ensure that all safety SOP's are observed throughout the test.

g. Thoroughly inspect the test item for obvious physical and electrical defects such as cracked or broken parts, loose connections, bare or broken wires loose assemblies, bent fragile parts, and corroded plugs and jacks. All defects shall be noted and corrected before proceeding with the test.

h. Prior to beginning any subtest, verify correct power source, necessary test instrumentation and inter-connection cabling, and that the equipment is aligned, if necessary, as specified in the pertinent operating instructions to ensure, insofar as possible, it represents an average equipment in normal operating condition.

i. Prepare a test item sample plan sufficient to ensure that enough samples of all measurements are taken to provide statistical confidence of final data in accordance with MTP 3-1-002. Provisions shall be made for modification during test progress as may be indicated by monitored test results.

j. Ensure that arrangements for supporting and participating agencies, activities and facilities have been made, and that authorization for electromagnetic radiation at specific frequencies, power levels, and modulations for required periods has been obtained. (NOTE: All tests, insofar as possible, shall be conducted in areas sufficiently free from interference and reflections).

k. Ensure that appropriate security measures are instituted to safeguard classified materiel and data, as applicable.

6.2 TEST CONDUCT

NOTE: Modification of these procedures shall be made as required by technical design of the item under test and availability of test equipment, but only to the extent that such modifications will not affect the validity of the test results.

6.2.1 Transmitter Tests

a. Perform laboratory tests of the test item's transmitter in accordance with the procedures given in MTP 6-2-222.

6.2.2 Receiver Tests

6.2.2.1 Laboratory Tests

a. Perform laboratory tests of the test item's receiver in accordance with the procedures given in MTP 6-2-222 or MTP 5-2-529, as applicable.

6.2.2.2 Receiver Noise Figure

a. Determine the receiver noise figure in conjunction with the receiver sensitivity measurement as described in MTP 6-2-222.

NOTES: 1. There are several basic methods of measuring noise figure.

In one method, a calibrated CW signal generator is applied to the receiver input, and the power at the output of the IF amplifier is indicated with a power meter. Assuming an impedance match at the receiver input, the output power is due to receiver noise alone. The signal generator power is then applied to the receiver input and adjusted until the signal-plus-noise power is equal to twice the receiver noise power read previously. The input signal power Sin may be read from the calibrated signal generator and the input noise power Nin is equal to KT Bn (with Bn found from receiver bandpass characteristics as measured in MTP 6-2-222). The above quantities permit the noise figure to be determined by substitution into the relationship:

$$F = \frac{Sin/Nin}{Sout/Nout}$$

or equivalently,

$$F = \frac{Nout}{KT\ BnG}$$

where K = Boltzmann's constant = 1.38×10^{-23} joule/deg.

Bn = bandwidth over which the noise is measured.

T = absolute temperature

G = available gain = Sout/Sin.

2. While the foregoing manual measurement and other techniques described in MTP 5-2-529 and 5-2-510 yield valid results, they represent a tedious process. Assuming the availability of commercial automatic noise measuring systems, a simple probe-and-read action may be prescribed with appropriate consideration being given to the constraints of mismatch, temperature, image and spurious response promulgated in reference 4H.

b. Record the noise figure together with any correction factor data or such data necessary to compute the noise figure in accordance with the relationships established in Step (a) above.

6.2.3 Antenna Tests

a. Perform measurements of the test item's antenna in accordance with the procedures given in MTP 6-2-020.

6.2.4 Moving Target Indicator Tests

6.2.4.1 Laboratory and Field Tests

Perform laboratory and field tests of the test item's moving target indicator function in accordance with MTP 6-2-222 or MTP 5-2-519, as applicable.

6.2.4.2 Threshold Velocity Detection Capability

a. Install suitable whirliflector radar targets along the radar Resolution Facility MTI Track.

NOTES: 1. The size of the whirliflector targets shall be determined as described in the Radar Minimum-Maximum Range subtest.
2. Whirliflectors shall be capable of attaining an angular velocity representative of the speed of the projectile under consideration.

b. Emplace the item under test at approximately the maximum detection range (as determined in paragraph 6.2.5.2) from the Radar Resolution Facility MTI Track. This location shall be along the vantage points corridor, in line with the MTI Track.

c. Fix the radar's azimuth and elevation and set its range gate to cover the center of the MTI track at the selected range.

d. Record the whirliflector target size, vantage point site number, and radar range and azimuth to target.

e. Determine the expected threshold velocity detection capability of the radar from applicable QMR or other appropriate criteria, and rotate the whirliflector at 20 percent speed below the expected speed.

f. Utilizing three operators selected at random, attempt to detect the target. Each of the three operators shall attempt three detections of the target.

g. Record the following information:

1) Target detection (yes or no)
2) Target velocity
3) Mode of detection used

h. Repeat Steps (f) and (g) above at whirliflector speeds of 10 percent below, 5 percent below, 5 percent above, 10 percent above, and 20 percent above the expected threshold velocity detection capability of the radar.

i. Equip the target cart with corner reflectors simulating a 1/4 ton truck, a man or other appropriate target and repeat Step (f), above.

j. Record the following information:

1) Target size for each trial
2) Radar range and azimuth to target
3) Target cart velocity
4) Target detection (yes or no)
5) Mode of detection used

k. Repeat the entire test with the radar emplaced approximtely 3,000 meters, and at 50 meters from the Radar Resolution Facility MTI Track.

6.2.5 <u>System Tests</u>

6.2.5.1 Radar Performance Figure

a. Determine and record the radar performance figure in accordance with the procedures given in MTP 6-2-222. The radar performance figure test shall be performed on a daily basis throughout the test period in order to give a complete record of performance of the specific radar set under test.

6.2.5.2 Radar Minimum-Maximum Range

6.2.5.2.1 Target Sizes - Determine target size as follows:

a. Site the radar under test approximately 3,000 meters from the apex of the Radar Resolution Facility.

b. Position 60-mm mortar of 175-mm projectiles or other appropriate targets in the vicinity of the apex of the Resolution Facility. Various sizes of corner reflectors shall be alternately located near the apex.

c. Alternately acquire the corner reflectors and projectiles with the radar to determine, as closely as possible, the corner reflector size that best simulates the required projectile.

d. Record the reflector sizes that best simulate the appropriate targets.

e. Repeat Steps (c) and (d) above, as required to determine the target size of other appropriate targets.

f. Replace the corner reflectors with whirliflectors and repeat Steps (c) and (d) above to determine the size of the whirliflectors which best simulate the above targets when the targets are moving.

g. Utilizing the appropriate weapon and crew, fire ten rounds of each size projectiles and determine the validity of the size of the above selected targets.

6.2.5.2.2 Minimum Range - Determine minimum range as follows:

a. Install corner reflectors on the Radar Resolution Facility representing the size of the target specified in the applicable design criteria (or in accordance with MTP 6-2-036).

b. Site the radar under test at a Resolution Facility vantage point approximately 50 meters from the targets installed in Step (a), above.

c. Utilizing three operators selected at random, attempt to detect the targets both aurally and visually (as applicable). Each of the three operators shall attempt three detections of each target and shall be denied access to the range and azimuth readout of the test item.

d. If the targets are detectable, record data on the form given in Figure 1, move the test item closer in range from the targets, and note the range at which targets are no longer detectable.

e. If the targets are not detectable at the range specified in Step (b) above, move the test item out in range from the targets, and note the range at which the targets are first detectable.

f. Replace the corner reflectors installed in Step (a) above, with whirliflectors rotating at an angular velocity representing the speed of the

projectile under consideration, and repeat Steps (b), (c), (d) and (e) above to determine MTI minimum range.

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Date _____ Radar Serial No. _____

Time _____ Corner Reflector Size _____

Operators:

1. _____ 2. _____ 3. _____

Wind Speed _____ knots Wind Direction _____

Radar vantage point coordinates: _____ _____

Trial No.	Oprtr Init.	Target Number 1				Target Number 2			
		Azimuth		Range		Azimuth		Range	
		Act (Mils)	Indic (Mils)	Act (m)	Indic (m)	Act (Mils)	Indic (Mils)	Act (m)	Indic (m)

Figure 1. Radar Minimum-Maximum Range and Resolution Data Sheet

6.2.5.2.3 Maximum Range - Determine maximum range as follows:

a. Install corner reflectors on the Radar Resolution Facility representing the size of the desired target (or multiples or portions thereof where the functions of detection, recognition, or identification are to be tested as in MTP 6-2-036.

b. Site the radar under test at a vantage point on the resolution facility approximately 10,000 meters from the targets installed in Step (a), above.

c. Utilizing three operators selected at random, attempt to detect the targets both aurally and visually (as applicable). Each of the three operators shall attempt three detections of each target and shall be denied access to the range and azimuth readout of the test item.

d. If detection is unsuccessful, move the targets toward the test item in 500-meter increments until detection is first accomplished.

e. Record maximum detectable range data on the form given in Figure 1.

f. Replace the corner reflectors installed in Step (a), above with whirliflectors rotating at an angular velocity representing the speed of the projectile under consideration, and repeat Steps (b), (c), (d) and (e) above, to determine MTI maximum range.

6.2.5.3 Radar Resolution Test

6.2.5.3.1 Range Resolution - Determine range resolution as follows:

a. Site the radar under test on vantage point 1 of the Radar Resolution Facility

b. Install corner reflector targets at position 4, spoke 1 and position 22, spoke 3 of the resolution facility.

NOTES:
1. Corner reflector target size shall be selected so as to provide a reflected signal whose amplitude will be above the background clutter, but not so great as to cause saturation of the radar receiver.
2. An initial range separation of 100 meters between targets shall exist.

c. Utilizing three operators selected at random, detect and then attempt to locate each target in range and azimuth and record these readings on the form given in Figure 1. Each of the three operators shall made three readings in random order, and shall be denied access to the range and azimuth readout of the test item.

d. Increase or decrease the distance between the two targets as indicated by the test results, and repeat Step (c), above until the exact extent of range resolution is determined.

e. Re-position the test item to a location which allows maximum range as determined in paragraph 6.2.5.2.3.

f. From this maximum range position (Step (e)), select two target positions, which give 100 meters separation in range and repeat Steps (c) and (d) above.

g. Repeat the entire test at ranges of approximately 1,200, 1,800, 2,500 and 3,300 meters from the radar.

6.2.5.3.2 Azimuth Resolution - Determine azimuth resolution as follows:

a. Repeat Steps (a), (b) and (c) of paragraph 6.2.5.3.1 above, except corner reflector targets shall be installed at position 4, spoke 2, and position 22, spoke 4 of the Radar Resolution Facility, giving an azimuth separation of 100 meters.

b. Increase or decrease the distance between the two targets as indicated by the test results, and continue to detect and locate the targets (as outlined in 6.2.4.3.1 (c)) unitl the exact extent of azimuth resolution is determined.

c. Re-position the test item to a location which allows maximum range as determined in paragraph 6.2.5.2.3.

d. From this maximum range position, select target separation along spokes 2 and 4 so as to allow a 100 meter separation in azimuth.

e. Utilizing the three operators selected at random, take a series of readings at maximum range and 100 meter separation as outlined in Step (b) above, until actual azimuth resolution at maximum range is determined.

f. Repeat the entire test at ranges of approximately 1,200, 1,800, 2,500 and 3,300 meters from the radar.

6.2.5.4 Radar System Accuracy

a. Site the radar under test at vantage point 1A on the Radar Resolution Facility.

b. Install the whirliflector targets as follows: at spoke 1, pole 18; spoke 2, pole 15, spoke 3, pole 20, and spoke 4, pole 8; and at the apex of the resolution facility.

NOTE: The 17 cm corner reflectors shall be used. They are expected to provide a reflected signal whose amplitude will be above the background clutter, but not so great as to cause saturation of the radar receiver. If, at any time during the test, there is difficulty in detecting the target or the receiver saturates, the target size shall be increased or decreased, as appropriate.

c. Prepare a target-call list containing the call sequence for activation as examplified in Figure 2, and furnish the control-house crew with a copy of the list.

NOTE: The Radar Resolution Facility target control operator will be instructed to activate the apex orientation target and the test personnel shall confirm the true azimuth readings of the radar.

d. Utilizing three operators selected at random, attempt to detect the targets as the control house operator activates the targets in the specified sequence. Each of the three operators shall achieve three readings

per target.

e. Record the following:

1) Data required by the data form given in Figure 3.
2) Test item mode of operation
3) Target type and size
4) Radar set and target locations
5) True range and azimuth
6) Indicated range and azimuth reading determined by each operator
7) Comments concerning the ease with which the targets were detected and located.

f. Repeat Steps (c), (d), and (e) above, for at least five vantage points out to the maximum radar range.

g. If applicable (for a boresight test):

1) Emplace the radar under test on the Radar Resolution Facility apex, and activate targets at four quadrants (pole 28 of spoles 1, 2, 3, and 4).
2) Orient the radar to spoke points.
3) Collimate the optical system with the electrical system on spoke 1, and check accuracy of the electrical and optical collimation on spokes 2, 3, and 4.
4) Record the readings of the radar unit readout mechanism at each point and transit azimuth readings to each of the points.

6.2.5.5 Mutual Interference Test

NOTE: The mutual interference test shall be conducted initially with two test items operating on the same tuned frequency and subsequently with the two test items on increasingly separated frequencies until mutual interference is not detected.

a. Site the first test item (Radar No. 1) in the center of a relatively flat rest area of at least 5,000 meters in radius. Site the second test item (Radar No. 2) 500 meters from Radar No. 1, and position a target vehicle at a range of approximately 4,500 meters from the two test items. (See Figure 4)

b. Orient Radar No. 1 to illuminate a target area 90 degrees from the target vehicle and 180 degrees from Radar No. 2. Orient Radar No. 2 so as to illuminate a target area 180 degrees from the target area illuminated by Radar No. 1.

c. Place both test items in operation, observe both radars for interference effects and false targets, and record the following:

1) Range and relative bearing for each case of interference
2) Scope photographs for conditions of no interference, false targets, and interference (the last two if they occur).

Call No.	Operator No.	Target No.
1	1	4 (S4, P8)
2	2	2 (S2, P15)
3	3	3 (S3, P20)
4	1	1 (S1, P20)
5	2	4
6	3	2
7	1	3
8	2	1
9	3	3
10	1	4
11	2	3
12	3	1
13	1	2
14	2	1
15	3	4
16	1	3
17	2	2
18	3	1
19	1	2
20	2	4
21	3	2
22	1	1
23	2	3
24	3	4
25	1	1
26	2	2
27	3	3
28	1	4
29	2	1
30	3	4
31	1	2
32	2	3
33	3	1
34	1	3
35	2	4
36	3	2

Figure 2. Sample Target Call List

RADAR-TARGET POSITIONS

Rdr Location (Vantage Points)	Target Locations	Distance (Meters)	Azimuth (Mils)
4	S1, P30	10,017	901
	S1, P29	9,953	901
	S1, P18*	9,682	899
	Apex	9,634	899
	S4, P8*	9,634	897
	S2, P15*	9,632	902
	S3, P20*	9,560	898
	S3, P36	8,612	891
3	S1, P18*	7,957	887
	Apex	7,909	887
	S4, P8*	7,910	886
	S2, P15*	7,907	890
	S3, P20*	7,845	884
	S3, P30	7,527	883
	S3, P35	7,016	877
	S3, P37	6,634	872
	S3, P38	6,124	864
2	S1, P18*	5,529	897
	Apex	5,481	896
	S4, P8*	5,481	894
	S2, P15*	5,479	901
	S3, P20*	5,417	895
	S3, P31	5,034	890
	S3, P32	4,970	889
	S3, P36	4,460	880.5

(Continued)

Rdr Location (Vantage Points)	Target Locations	Distance (Meters)	Azimuth (Mils)
1 (a)	S1, P18*	3,881	
	S2, P15*	3,833	
	Apex	3,833	
	S3, P20*		
	S4, P8*	3,833	
	S3, P34	3,065	
	S3, P37	2,553	
	S3, P38	2,041	
1200	S2, P15*	1,188	3859
	S4, P8*	1,188	
	Apex	1,188	4164
	S3, P20*	1,252	3829
	S1, P18*	1,140	3836
S3, P34	S1, P33	1,408	964
	S1, P28	1,024	964
	S3, P28	512	964
Apex	S4, P29	320	5764
	S4, P25	160	5764
	S4, P23	112	5764
	S4, P21	80	5764
	S4, P20	64	5764
	S4, P19	56	5764
	S4, P18	48	5764
	S4, P17	40	5764

Figure 3. Radar Target Positions

(False targets which cannot be readily identified as false targets shall be considered interference.).

d. If interference occurs, repeat Steps (a), (b), and (c) above, increasing the separation distance of the test items in 500 meter increments until no interference occurs or the separation is 7,500 meters.

e. If no interference occurs at the 500 meter separation, orient both test items so that each illuminates the target vehicle and repeat Step (c) above.

f. If no interference occurs during Step (e) above, rotate the antennas of the test items toward each other until either radar receives interference, or until either radar indicates interferences, or until the antennas are facing each other. When interference is noted, record the antenna positions.

g. During Step (f) above, note and record the range where there is no interference. Orient the two test items (at that range) so that the antennas are directed on the same relative bearing with the main lobes parallel.

h. Illuminate the target vehicle utilizing Radar No. 1 and, if no interference occurs, rotate the test item antennas toward each other until either radar indicates interference or until the antennas are facing each other. Record the antenna positions when interference occurs.

i. If interference occurs during the performance of Steps (e), (f), (g) and (h) above, orient Radar No. 1 as outlined in Step (b), above and Radar No. 2 so as to illuminate Radar No. 1, and Repeat Step (c) above.

6.3 TEST DATA

6.3.1 Preparation for Test

Data to be recorded prior to testing shall include but not be limited to:

a. Nomenclature, serial number(s), manufacturer's name, and function of the item(s) under test.

b. Nomenclature, serial number, accuracy tolerance, calibration requirements, and last date calibrated of the test equipment selected for the tests.

c. Damages to test item incurred during transit and/or manufacturing defects.

6.3.2 Test Conduct

a. A block diagram of the test setup employed in each specified test. The block diagram shall identify by model and serial number, all test equipment and interconnections (cable lengths, connectors, attenuators, etc.) and indicate control and dial settings where necessary.

b. Photographs or motion pictures (black and white or color), sketches, charts, graphs, or other pictorial or graphic presentations which will support test results or conclusions.

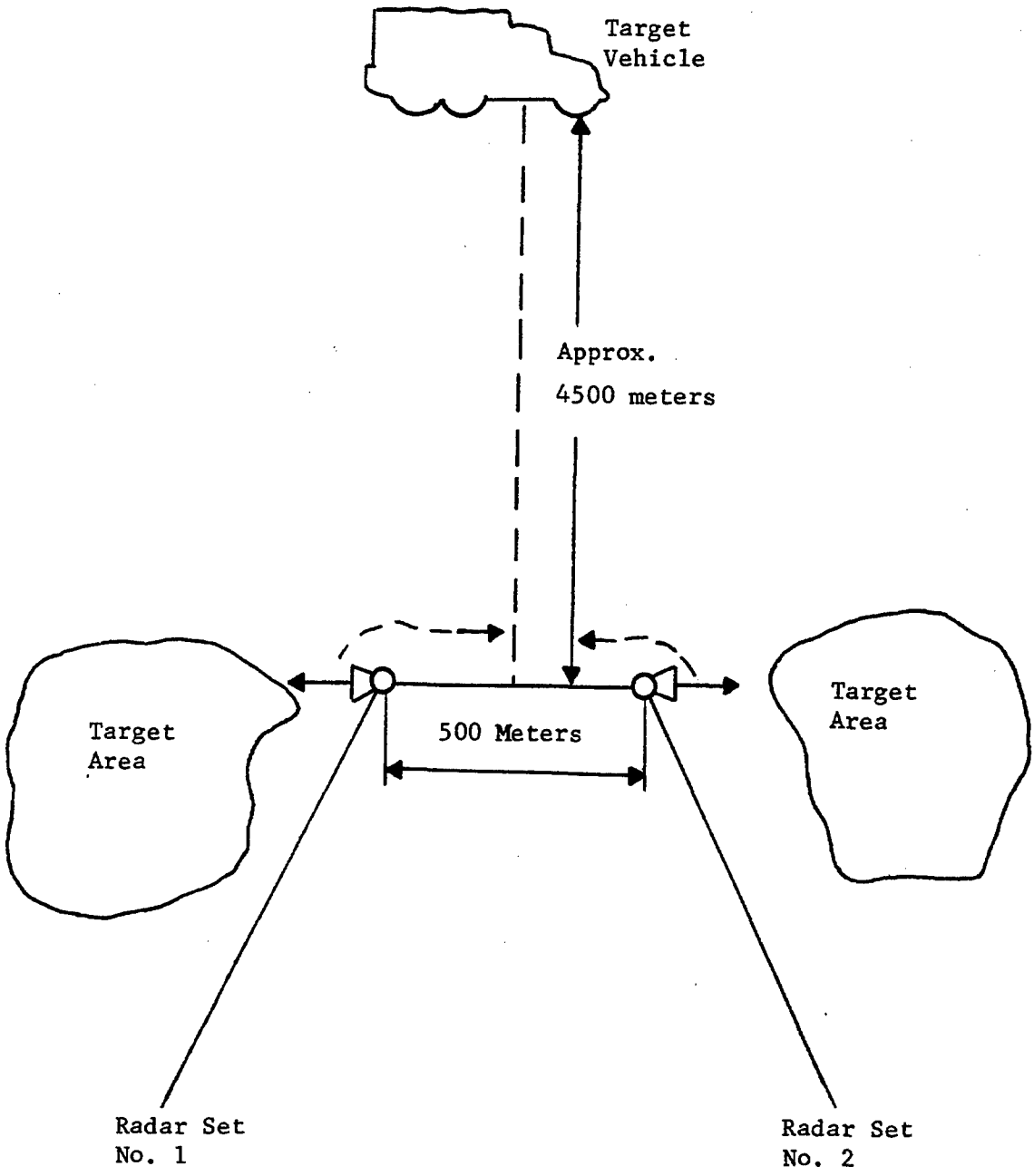

Figure 4. Mutual Interference Test Setup

c. An engineering logbook containing, in chronological order, pertinent remarks and observations which would aid in a subsequent analysis of the test data. This information may consist of temperatures, humidity, pressures, and other appropriate environmental data, or other description of equipment or components, and functions and deficiencies, as well as theoretical estimations, mathematical calculations, test conditions, intermittent or catastrophic failures, test parameters, etc., that were obtained during the test.

d. Test item sample size (number of measurement repetitions)

e. Test instrumentation or measurement system mean error stated accuracy.

6.3.2.1 Transmitter Tests

Transmitter test data shall be recorded as indicated in the applicable portions of MTP 6-2-222.

6.3.2.2 Receiver Tests

6.3.2.2.1 Laboratory Tests - Laboratory receiver test data shall be recorded as indicated in the applicable portions of MTP 6-2-222 or MTP 5-2-529.

6.3.2.2.2 Receiver Noise Figure - Receiver noise figure data shall consist of the receiver noise figure together with any correction factor data or such data necessary to compute the noise figure in accordance with the relationships established in paragraph 6.2.2.2.

6.3.2.3 Antenna Tests

Antenna test data shall be recorded as indicated in the applicable portions of MTP 6-2-020.

6.3.2.4 Moving Target Indicator Tests

6.3.2.4.1 Laboratory and Field Tests - Cancellation Ratio, Clutter Rejection, Sub-Clutter Visibility, Blind Speed, Scanning Modulation and other general moving target indicator subtest data shall be recorded as indicated in the applicable portions of MTP 6-2-222 or MTP 5-2-519.

6.3.2.4.2 Threshold Velocity Detection Capability - Threshold Velocity test data to be recorded shall consist of:

a. Target size for each trial.
b. Radar range and azimuth to target.
c. Target detection (yes or no).
d. Mode of detection used.
e. Vantage point site number.

6.3.2.5 System Tests

6.3.2.5.1 Radar Performance Figure - Radar Performance Figure test data shall be recorded in accordance with MTP 6-2-222.

6.3.2.5.2 Radar Minimum-Maximum Range - Record the following:

a. Reflector sizes that best simulate appropriate target sizes in tablular form.
b. Radar minimum range data on the data form given in Figure 1.
c. Radar maximum range data on the data from given in Figure 1.

6.3.2.5.3 Radar Resolution Test - Record the following:

a. Radar range resolution data shall be recorded on the data form given in Figure 1.
b. Radar azimuth resolution data shall be recorded on the data form given in Figure 1.

6.3.2.5.4 Radar System Accuracy - In addition to the data required by the data form given in Figure 3, the following parameters shall be recorded as a part of the radar system accuracy test record:

1) Test item mode of operation
2) Target type and size
3) Radar set and target locations
4) True range and azimuth
5) Indicated range and azimuth reading determined by each operator.
6) Comments concerning the ease with which the targets were detected and located.
7) Where a boresight test was conducted:

a) Readings of the radar unit readout mechanisma at each point.
b) Transit azimuth readings to each of the points

6.3.2.5.5 Mutual Interference Test - Mutual interference test data shall include:

a. Range and relative bearing for each case of interference
b. Scope photographs for conditions of no interference, false targets, and interference (the last two if they occur).

6.4 DATA REDUCTION AND PRESENTATION

Processing of raw test data will, in general, consist of:

a. Converting units of measured parameters to units of measure as expressed in the applicable criteria or test item design specifications.
b. Constructing suitable graphical presentations of test data to facilitate analysis and comparison.
c. Applying statistical theory where necessary to determine measures of central tendency and distribution of data.

d. Determining test item performance (as indicated by test parameter values) relative to test criteria or test item specifications.

All test data shall be properly marked for identification and correlation and grouped according to subtest title. Specific instructions for the reduction and presentation of individual subtest data are outlined in succeeding paragraphs.

6.4.1 Transmitter Tests

Transmitter test data shall be reduced and presented in accordance with applicable portions of MTP 6-2-222.

6.4.2 Receiver Tests

6.4.2.1 Laboratory Tests

Laboratory receiver test data shall be reduced and presented in accordance with applicable portions of MTP 6-2-222 or MTP 5-2-529.

6.4.2.2 Receiver Noise Figure

The receiver noise figure shall be presented for comparison with test criteria.

6.4.3 Antenna Tests

Antenna test data shall be reduced and presented in accordance with applicable portions of MTP 6-2-020.

6.4.4 Moving Target Indicator Tests

6.4.4.1 Laboratory and Field Tests

Cancellation Ratio, Clutter Rejection, Sub-Clutter Visibility, Blind Speed, Scanning Modulation and other general laboratory or field moving target indicator data derived from subtests performed in accordance with MTP 6-2-222 or MTP 5-2-519 shall be reduced and presented accordingly.

6.4.4.2 Threshold Velocity Detection Capability

Threshold velocity test data shall be presented in a tabular format most suited for analysis of the data with respect to test criteria. Detection shall be judged to exist when at least seven of nine trials (or other criteria), at each discrete speed, correctly indicate that the operator detects the target.

6.4.5 System Tests

6.4.5.1 Radar Performance Figure

Radar performance figure test data shall be reduced and presented in accordance with applicable portions of MTP 6-2-222.

6.4.5.2 Radar Minimum-Maximum Range

The completed data form indicated in Figure 1, shall be presented as the radar minimum-maximum range test record. Detection shall be judged to exist when at least seven of nine trials (or other ratio, as applicable) at each discrete range, correctly indicate that the operator detects the target.

6.4.5.3 Radar Resolution

The completed data form indicated in Figure 1, shall be presented as the radar resolution test record. Radar range and azimuth resolution as extracted from the data form shall be presented for comparison with test criteria or test item specifications.

6.4.5.4 Radar System Accuracy

The completed data form indicated in Figure 5, together with the data specified in paragraph 6.3.2.5.4 shall be presented as the radar system accuracy test record.

Statistical reduction of the data shall be accomplished to determine if the equipment meets the accuracy criteria. Accuracy criteria is normally judged to have been met if, with 95 percent statistical, it may be stated that at least 90 percent of the theoretical population of errors lie within the accuracy limits. A gaussian distribution of errors may be assumed unless the data exhibit evidence to the contrary.

The error variances among operators and among replicate readings will be estimated.

A comparison will be made of the accuracy and ease of acquiring targets in the various equipment operating and detecting modes.

6.4.5.5 Mutual Interference Test

Range and bearing for each case of interference together with suitable scope photographs shall be presented for comparison with applicable criterion.

TARGET DETECTION DATE: SHEET NO.

RADAR SET SN RADAR LOCATION OBSERVER:

TIME START	TARGET		TGT. SIZE	AUR. RET.	VIS. RET.	RADAR		TIME FREQ.	STOP	OPERATOR
	SPOKE	POLE				RANGE	AZ			

REMARKS:

WEATHER:

TARGET SPACING TGT RPM

Figure 5. System Accuracy Data Sheet